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**Title:** The woman behind the curious invention of modern software Klára Dán von Neumann's handwritten letters confirm her legacy

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## The woman behind the curious invention of modern software Klára Dán von Neumann's handwritten letters confirm her legacy

By Historian **Nic Lewis** ([WRS-NSRCMS](#)) and [National Security Research Center](#) staff

The year 1945 marked not only the birth of the atomic age, but also the birth of modern computer programming. The first fully electronic computing machine, the ENIAC (Electronic Numerical Integrator And Computer), came online in December 1945. But programming the ENIAC was an excruciatingly difficult task. **Klára Dán von Neumann**, who joined the Laboratory at Los Alamos after WWII, helped to revolutionize the process, creating the very first modern computer programs.

Built at the University of Pennsylvania for the U.S. military, the ENIAC was the first electronic, general-purpose computer ever created, meaning that it could be reprogrammed for almost any problem. It would eventually perform numerous weapons-science calculations — including those for thermonuclear weapons. But the ENIAC in its original form could only be reprogrammed by tediously rewiring the machine and setting thousands of switches on its control panels. Taking weeks or months to reprogram, this limited the computer's utility to Los Alamos scientists and other ENIAC users.

In 1947, the ENIAC team at Los Alamos sought to solve this problem by converting the machine into something new, a machine that could store its programs in the same internal memory as its working data. This would theoretically make the ENIAC extremely fast to reprogram — no longer needing to rewire the machine for each problem. But it meant someone needed to figure out how to write the very first executable software program. This is where Dán von Neumann stepped in.

At a time before programming languages or programming aides of any kind, she produced the first software coded in the modern paradigm, which were Los Alamos Monte Carlo problems. According to **Nic Lewis**, a historian at the Lab's National Security Research Center (NSRC), "There was no library of example code for her to draw upon. Her codes were written in the very Byzantine machine language of the ENIAC, which required a great deal of intelligence, ingenuity and creativity to do as there were no established procedures to act as guidance. She had to invent the procedures as she went along."

Dán von Neumann's ingenuity stemmed from having to know the physical architecture of the ENIAC in significant detail. "It was a labyrinthine machine, one that the ENIAC Los Alamos team, made up of **Nicholas Metropolis** and Dán von Neumann, and the

team in Aberdeen, Maryland, had to modify to function as a stored-program system. Because of how it had to be modified, it had a lot of quirks that made it far from ideal to work with, Lewis said.

## **Preserved legacy**

Yet Dán von Neumann not only took on the grueling and tedious work of learning ENIAC inside and out, she was also intrigued by her work.

“The NSRC collection includes handwritten letters from Klára to Nick Metropolis where she said that the machine was ‘wonderful’ because of the fascinating abilities and challenges it presented. So, to be the first simply to program, or ‘code,’ a computer like the ENIAC (of which there was only one) required someone of extraordinary intelligence and abilities,” Lewis said.

Sometimes, looking back at historical achievements with our modern lens can minimize their significance. Dán von Neumann’s work was monumental indeed, but “that tends to get lost in historical interpretations because we assume that what she did was equivalent to programming now, but it was far, far more challenging and pathfinding,” Lewis said.

## **Looking for more?**

Listen to [this podcast series](#), which gives an in-depth look at Klára Dán von Neumann’s life and work. National Security Research Center Historian Nic Lewis is one of several historians interviewed for this series by Scientific American.

More photos and stories about Klára Dán von Neumann are part of the collections at the NSRC, the Lab’s classified library located in the National Security Sciences Building. You may know one — share your favorite Dán von Neumann story, or a story of other women in LANL history, with us! Contact us at [nsrc@lanl.gov](mailto:nsrc@lanl.gov).

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## **EVENT SIDEBAR**

In recognition of Women’s History Month, the Women’s Employee Resource Group hosts a National Science Research Center (NSRC) presentation via Teams on Wednesday, **March 22**, at **10 a.m.**

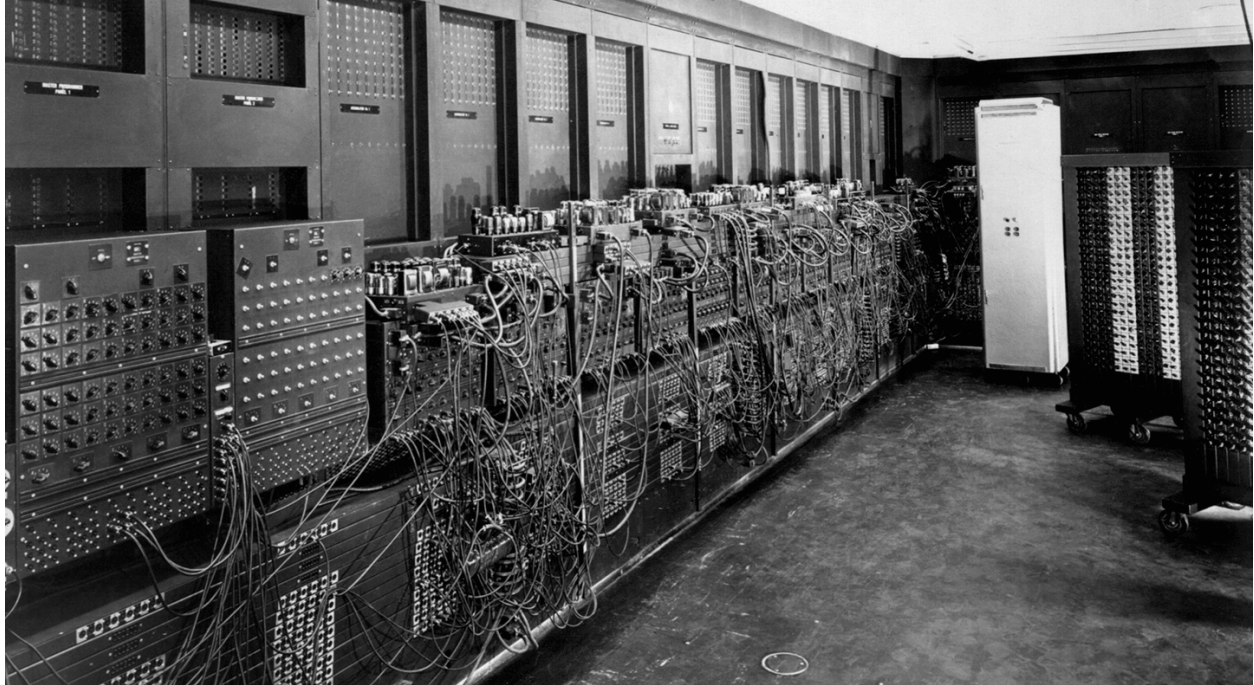
Speakers from the NSRC will provide an overview of the women who contributed to the early days of the Laboratory — including Klára Dán von Neumann!

Stay tuned to LANLToday for more event details and meeting info.



Caption: Klára Dán von Neumann, her spouse John, and their dog, Inverse. John von Neumann was a mathematician who also worked at the Los Alamos Lab.





Caption: ENIAC, the first electronic, general-purpose computer, weighed more than 27 tons, took up 1,800 square feet and consumed 150 kilowatts of power.

**RECOMMENDATION FOR CHANGE OF STATUS** OK  
LH

Name:	Klara von Neumann	Group:	T-2
	Salary	Job Classification	Effective Date
Proposed:	285 per month \$ 1.35/hr	SC-8	Feb. 1, 1948
Present:	212 per month (1.225/hr.)	SC-8	11/1/47 (gen. inc.)
Previous:	195 per month (1.125/hr.)	SC-8	7/30/47 (new hire)

**RECOMMENDATION OF GROUP LEADER:**

This should include (a) type of work done by employee: (b) quantity and quality output of the individual: (c) standing of individual in his group as a whole, and in job classification within his group: (d) nature of change in duties, responsibility, skill, etc., to justify the increase.

Employee had good background in general computing when hired but has worked for us on coding problems for the ENIAC with which she had no previous experience. She has become very proficient at this and is now of considerably increased value to us as the only computer on our staff with detailed knowledge of the ENIAC. *Mrs. von Neumann is highly recommended for this merit increase.*

Caption: Klara Dán von Neumann was highly recommended for a promotion in 1948 due to her critical and pioneering expertise of the ENIAC.